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## MANUAL CONCEPTS: A STUDY OF THE INFLUENCE OF HAND-USAGE ON CULTURE-GROWTH.

BY FRANK HAMILTON CUSHING.

### INTRODUCTORY.

*Steps toward man's intellectual development.*—If we assume that there have been three great steps in the intellectual development of man, the biotic, the manual, and the mental—

(a) *The biotic.*—Then, during his biotic development, man, as a genus of animal species merely, had progressed so far as to have free hands. Though these may have been developed in climbing, yet he had not now either to creep or to climb, but could walk erect; could fend and defend freely with these hands.

(b) *The manual.*—It was then that man began to develop extra-naturally; no longer like the mere animal, by coercion of the direct forces of natural environment, but rather by making an environment of his own, and this, first, by means of his hands—that is to say, this experience in warding off the blows of nature with his hands gave rise to devising, in which is to be sought the beginning of formal mentation—that is, of conscious ratiocination, as compared to instinctive consciousness and volition. Therefore I have named this period of man's development from his ancestral animal species, both physically and mentally, the manual.

(c) *The mental.*—No one has better defined the next period of man's development than our true-seeing teacher, Major Powell, when he states that the mental step or stage depends on the ascer-

tainment of *truth*. The degree to which man, practically, intellectually, or spiritually, ascertains truth determines the degree of his security and conditions his fitness for survival and prevalence; but man attained to both the perception and formal ascertainment of truth first through the *use* of and then through the *using* of his hands. The survivals of this are as striking as they are abundant. Let us examine only a few of them—this more in the way of suggestion for, rather than as the results of, adequate study.

I think that man is what he is, even racially to a certain extent, through this same use and using of his hands, he having been domesticated thereby, or by himself unconsciously, so far as to have changed himself and the degrees and *modus operandi* of the causes in outside nature which affected his development as an animal. If this be true of man in a general racio-physical sense it is certainly and much more obviously true of him in more special ways; as, for instance, in so far as he has modified himself by persistent custom or usage—usage rendered persistently specific through the limitations of his organism—his members acting upon and acted upon by environment, according to his condition.

For example, learned treatises have been written from all sorts of standpoints to account for the universal right-handedness of our race. It has appeared to me that the essential usages of primitive life have made man universally right-handed, or at least emphasized and confirmed in him any organic tendency that way; so that no students can ever have found a tribe or nation of wholly left-handed or even ambidextrous people, nor trace of them in art remains, although in the latter we may look among the earlier for more frequent signs of such than among the later.

Man the savage fends for life principally with weapons of war and the chase, of offense and defense. His heart, the most vulnerable part, is in his left side, which he would therefore even emotionally turn away from danger and encounter; but, more than this, his condition of life implies always the shield and the club. He has naturally always carried the shield over the heart with the left arm and hand; the club, lance, or sword in the right hand. He has thus *acted* constantly with the right hand; *carried* as constantly with the left. It is only natural, then, that in ritualistic talk the Zuni should have called the personified right hand the "Taker," the left hand the "Holder," going so far as to deify the left and

right members of the Sun Father as the Elder and Younger God-Twins of War and Chance—A'-hai-yu'-ta and Ma'-tsai-le'-ma—one the deliberate, the counsellor, and maintainer ; the other the impetuous, the proposer, and doer.

In this we already have an example of the agency of hand-usage in framing mind or forming both mythic concepts and religious beliefs, along the line of which one might follow far the upward growth of culture in a special people ; but the example serves also to introduce to us a clearer, more distinctly graded line, each advance of which may be obviously traced and which is, in much greater measure, of universal applicability to studies of culture-growth in the entire human race.

The question has been asked, Why have we a cumbersome decimal system of enumeration when it is well known that a duodecimal system would be better? The question has been answered by Dr. Tylor and by many others, as by myself—we have the decimal system because we have pentadactylic hands. Whether we would or no, despite our mind, these hands have imposed upon us both the names and the figures for our numbers and numberings. The need for knowing in number arising in primitive time, *they* first responded ; the will to know, *they* formed the way of knowing—the knowledge itself, for that matter. However well understood this may be as a general statement, I do not think the process of it has ever been quite fully or far enough traced out.

I. *Evidence of hand influence in the formation of terms in spoken language.*—By combining a sense of manual aptitude with the etymology of quantitative terms in at least the Zúñi language, I will feel my way back, step by step, to the far ancient hand-conception and birth of many such terms. I think it can thus be shown that, while the creator of such terms has been the human will, the father of them has been the right hand, the mother of them the left hand ; that numerals have been finger-made and sums hand-made ; further, that single terms or monophrastic words of many sorts have been single-hand made, and sentence-words or holophrastic terms have as often been double-hand or gesture made.

The immediate bearing of these latter facts is important, since they go far toward explaining why languages have been always ahead of themselves, so to say, grammatically ; for they indicate that the very earliest uttered verbal speech was already framed

complexly by the two hands—one acted upon, the other acting upon it. That such speech as a whole had already advanced grammatically beyond the simple “bow-wow” stage and was, at the very outset, neither merely monosyllabic nor polysyllabic, but was—as from a purely psychologic standpoint Major Powell has independently demonstrated—necessarily a combination of these, or in part one, in part the other. And I venture further to say that it was full born with not a few well-marked parts of speech.<sup>1</sup>

II. *Right- and left-handedness as affecting the development of spoken numerals.*—Not so much to illustrate this genetic relation of the hands to speech-concepts as to show how essentially and very significantly right- and left-handedness has modified them, let us consider further the evolution of spoken numerals.

Admitting the universality of right-handedness and of the tendency to number with the fingers, then the right hand has ever been the counter, the fingers of the left hand the ones counted. Primitive man when abroad never lightly quit hold of his weapons. If he wanted to count, he did as the Zuñi afield does to-day; he tucked his implement under his left arm, thus constraining the latter but leaving the right hand free that he might check off with it the fingers of the rigidly elevated left hand. From the nature of this position, however, the palm of the left hand was presented to the face of the counter, so that he had to begin his score on the little finger of it and continue his counting from the right leftward. An inheritance of this may be detected to-day in the confirmed habit the Zuñi has of gesticulating from the right leftward with the fingers of the right hand over those of the left, whether he be counting and summing up or relating in any orderly manner. The subtle, far-reaching influence on mind, as well as on speech forms, of such simple and natural practices as these, arising from necessity in the way shown, has been so important that I do not hesitate to present the very tedious a, b, c's of its Zuñi record before proceeding to read that record further and translate more entertaining passages from it.

*Vigesimal stage.*—This record begins with the number One, or *tōp'-in-te*, which signifies “taken to start with,” or, to be less explicit but more literal, “take-up-start-which-always-is-done-with-is.” It is from (1) *p'-pi*,<sup>2</sup> to take up, in the sense of starting with; (2) *in*, *i'-na*, the inself, in-dwelling quality, trait, or function of any-

thing<sup>3</sup>—it here signifies that which (itself which) always is (has)—and, finally, (3) *te'*, from *te'-u-o-na*,<sup>4</sup> (has) done to it—that is, *in-te'* means the particular thing to which anything is done; in this case the finger first taken up (Fig. 1).

The original meaning all this was intended to convey was, “that finger we always take first to count with,” the equivalent of which, as a concept, was the little finger held up and dropped or put down, as implying *one counted*. The Zufi language, like many another, had no name for each or any one of the four fingers. There was no such thing in it as spoken number with which otherwise to designate any one of them. What had to be done was what has been and what will further be shown was done. The process of counting the fingers of one hand with those of the other had to be described or indicated by vocal sounds.

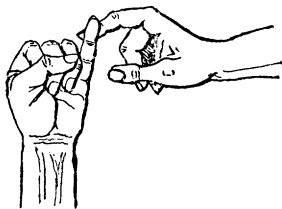


FIG. 1.

Thus, also, *kwil'-lin* (spoken alone) or *kwil'-li* (when counted), Two, originally expressed “dropped or put down together with that which,” etc.; from (1) *kw'-i'-ho*,<sup>5</sup> to drop or let go hold of; (2) *i'-wi-li*,<sup>6</sup> together (with) like; (3) *na*, from *i'-na*, that which, etc., (as above). So we may say that the thought this conveyed was something like “that-(finger)-we-put-down-with-the-like-of-it,” the equivalent concept of which was the next finger held up with the little finger (Fig. 2) and with it put down as implying *two counted*.



FIG. 2.



FIG. 3.



FIG. 4.

*Ha'-in* (spoken alone) or *ha'-i* (when counted), Three, was more ingeniously but far less simply devised as the “parter-equally-itself-which-does,” etc. (the middle or dividing finger being meant; Fig. 3), by deriving it from *i'-ha-k'i-a*,<sup>7</sup> to divide equally or part in

the middle. This conveys much more clearly than English can render it, "the equally-dividing finger [*lit.*, 'the finger which separates the first taken and together with it fingers from the next last and cut off from it fingers'] which always we, as to the others, to it do," the equivalent of which as a concept was the little, next, and middle fingers together held up (Fig. 4), etc., as scoring three.<sup>8</sup>

*A'-wi-ten* (spoken alone), or *a'-wi-te* (counted), Four, is extraordinary, not only as a concept, but also as a device in sound for designating the (with us) index, or forefinger, as the *last* finger in counting four. It is a contraction of the sentence-word *a'-wi-ten-na*, all-of-itselfs (them) to-be-done-with-going, or all-of-them (-selves) being-done-with-about-to; from (1) *a*, all, denoting, as a prefix, all of several; (2) *wi*,<sup>9</sup> of itselfs, and (3) *ten'-a*,<sup>10</sup> to be almost used up. Thus the meaning this conveyed may be seen to have been "all of the fingers all but done with," the equivalent of which as a concept was all of the fingers except the thumb (Fig. 5) held up and clasped down as implying *four* counted.



FIG. 5.

*Öp-ten* (spoken alone), or *öp-te* (counted), Five, completes the list of origination-names of numbers, so to term them. Referring to the thumb, it simply means "the notched off" or "the cut off" (individual); from (1) *öp'-tse*<sup>11</sup>, to cut or notch, and (2) *nd'-na* or *d'-na*, used only as a suffix and meaning "the one which does" (makes), or "the one which is (meant)." The obvious meaning this conveyed was that the thumb was meant, the concept of which meaning may have been either the whole hand held up with the thumb separated, or notched away, from the other fingers (Figs. 6, 7), as implying *five*, or that the end or cut-off point (*öp'-ti-na-ne* or *öp'-tsi-na-ne* similarly derived; see note 11) had now been reached. At any rate, there is evidence that for a long period five was veritably the notched-off point or end of Zuni counting.

*Decimal stage.*—When the enumerative attempt was again made, out of a long usage of the word one, another had been evolved from it, which, if possessed at the outset, would have saved much trouble in name-number devising—namely, *to'-pa*, signifying "another."



FIG. 6.

Thus, six became simply *to'-pa-li-k'ya*, which evidences, moreover, that in going on thenceforward the ancient Zúñis merely performed and voiced simple additions with the natural abacus of their two hands. Thus, *to'-pa-li-k'ya* signifies "another-bring-to-add-put-with-done (or made so to)." It is condensed from *top-ä'thl-il'-li-k'ya*, derived in turn from (1) *to'-pa*, another (from the word one; see note 2, etc.); (2) *a'thl'-na*,<sup>12</sup> bring to, add to; (3) *i'-li*, with (from *i'-wi-li*, together with, as in note 6), and (4) *k'ya* (the past participial ending like our own -ed), did, done.<sup>13</sup>



FIG. 7.

The meaning this conveyed was that all of the fingers and thumb of the left hand being held up (as for five counted—Fig. 7), another,

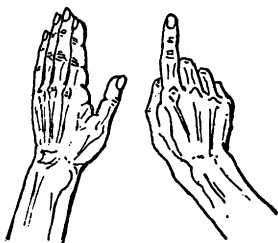


FIG. 8.

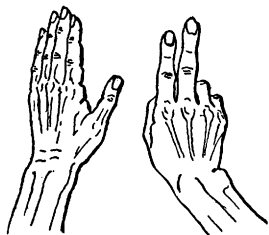


FIG. 9.

of the right hand, was brought and held up with them (Fig. 8) as indicating *six* counted.

Seven, *kwi'-li-li-k'ya*, simply means two (fingers of the right hand) brought to and held up with the rest (of the left hand—Fig. 9); and eight, *ha'-i-li-k'ya*, three fingers so held up, etc. (Fig. 10).

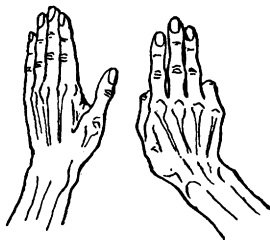


FIG. 10.

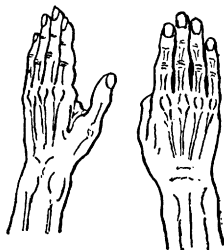


FIG. 11.

But in Nine, *ten'-a-li-k'ya*, this process has been varied; that is, instead of trying to repeat the word four (as two and three had been



repeated in forming seven and eight), the process or principle of the *formation* of four is repeated or applied, so that the significance of *ten'-a-li-k'ya* is that "all but all [of the fingers of the right hand] are held up with the rest" (meaning the left—Fig. 11).

Etymologically, Ten, *äs'-tem-'thla* (spoken alone), is the most transparent of all the number-names, for it simply means "all of the fingers;" from (1) *äs'-si*, fingers together (or as one—Figs. 12 and 13), and (2) *tem'-'thla*,<sup>14</sup> all.

Again, for a long period the primitive Zúfi seems to have paused at this next step in number building, simply saying "all of the fingers and"—whatever other number he fain would add, developing thereby, it may be, his independent word for "and" (*ta*) from

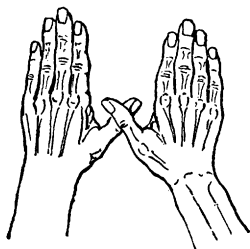


FIG. 12.

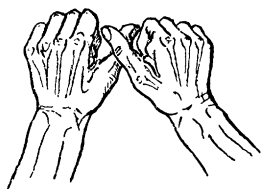


FIG. 13.

*to'-pa*. Be this as it may, his word for Eleven at last took the form of *äs'-tem-'thla to-pa-yä' thl'-to-na* (spoken alone), for he could not say again, "another put with the rest" (or with all that had been counted), since this would have but signified six again. He therefore said "all-of-the-fingers-and-another-over-above-held" (or cast up); for *äs'-tem-'thla to-pa-yä' thl'-to-na* is formulated from (1) *äs'-tem-'thla*, fingers all; (2) *ta*, and; (3) *to'-pa*, another; and (4) *yä' thl'-to*<sup>15</sup>, laid upon or cast upon.

With twelve, thirteen, and so on, to nineteen, the process was but a repetition of this; but when twenty was reached, yet another device is discernible in the middle syllables of this number, *kwił'-li-k'yën-äs'-tem-'thlan* (spoken alone) or *kwił'-li-k'yën-äs'-tem-'thla* (counted), from (1) *kwił'-li*, two; (2) *k'yën*,<sup>16</sup> times done; (3) *äs'-tem-'thla*, ten—that is, "two times all of the fingers. One hundred is simply *äs-si-äs'-tem-'thla-k'ya*, or "the fingers all of the fingers (done to);" but one thousand is *äs-si-äs'-tem-'thla-na-k'yën-äs-tem-'thla*, "the fingers all of the fingers times (done to) all of the fingers."

III. *Right- and left-handedness as affecting the development of recorded numerals and writing.*—I have said that this study of hand influence simply in Zúñi number making and naming, etc., would apply almost universally and similarly to the study of such features in the growth of other cultures, and it remains to be represented in what wise and to what extent this is true.

(a) *The threshing score.*—Every one knows that the ancient score of Scandinavia and Anglo-Saxondom—our own threshing score—consists of four straight upright marks conjoined by a line drawn diagonally across them from right to left, to tally five (Fig. 14, a), and if the record be indefinitely continued, then in the succeeding set of marks the diagonal line is sometimes reversed, to tally ten (Fig. 14, b).

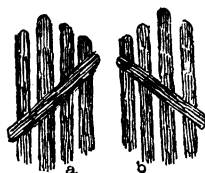


FIG. 14.



FIG. 15.

This serves to launch us forth on the second line of our inquiry, for it looks as though these scores were at first only crude pictures suggested by the fingers of the left hand held up straight with the thumb folded across them to denote five (Fig. 15, a), and of the right hand similarly held by its side to signify ten (Fig. 15, b).

(b.) *The Roman numerals.*—But a less questionable and far better evidence of hand influence on graphic, not less than on spoken, numeral-making may be educed from a comparative examination and analysis of the letters selected and the methods employed in combining them to depict numbers according to the Roman system.

It seems more than probable that the figures or letters in this system representing all numbers up to ten, at least, were selected or devised<sup>17</sup> by their earliest inventors, in either deliberate or spontaneous imitation of the fingers of, first, the left hand, then of the right, as used and seen in counting. With this idea in mind, it is not difficult to perceive in one I, two I's, and three I's the little, next, and middle fingers as used in counting one, two, and three, and as illustrated in Figs. 16, 17, and 18. The ancient recorder of numbers found, however, in going further than this (in representing four, five, etc.) a necessity for modifying the uniformity of these straight number-marks in order that he need not stop to count them

each time he would determine their collective value in any given number. It is curious that his first effort to meet this requirement was but a repetition of the method employed by the primitive Zúñi in formulating his word or sound-symbol for the same number. To denote the finger-count for this number (four), the latter said, "all of the fingers [of the left hand] all but done with;" that is, all ex-



FIG. 16.



FIG. 17.

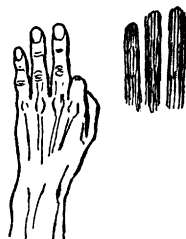


FIG. 18.

cept the last, the one before, or the one lacking the last. Practically, the Latin or the pre-Latin scribe did this, too, in formulating his symbol of the same number; for, conceiving the whole hand held up with the thumb extended as representative of five (Fig. 20) and then adopting or making a V to represent this in turn, he has placed an I before his V to symbolize four, by indicating that the number



FIG. 19.



FIG. 20.

meant is the next to the last one of the first division or hand; in other words, the one before, or one less than five, namely, four (Fig. 19). Moreover, when the fingers are held up with the thumb clasped in, they are so separated as to suggest, in themselves, the figure IV. Precisely as the Zúñi went on from the "notch" or V,

so the writer goes on by adding to the right side of this V, or placing after it one I, two I's, and three I's, for his six, seven, and eight (Figs. 8, 9, 10). When he reaches nine, however, his process of formulation of the symbol of this number is seen to have been not less analogous to his earlier process (for four) than was the Zúfi's to his, when he dealt with the same number. For, unavoidably taking the two extended hands with the *thumbs crossed* (Figs. 12, 13) to represent ten as a whole number or a number by itself,<sup>18</sup> and then adopting X to represent this in turn, he repeats, as the Zúfi repeated, much the same process he used in devising four; that is, places an I before the last number-sign (X, or ten) to indicate one less than, next to, or before it; that is, nine. It will be observed that this order of succession in recording the combined number signs reversed the direction of progression in the earlier counting or number development. None the less, it is still an effect of sinistral number-making, for it obviously had origin in the habitual turning toward the left to begin with, as well as in the addition from the right hand of all number elements exceeding and succeeding five; and, again, in the dextral appearance of the left hand as seen by the spectator or one counted to.

(c.) *The Chinese numerals*.—Dr. Weston Flint called my attention to the Chinese numerals as possibly originally pictographic in some such way. On examining the earlier forms of these characters expressive of number, I find that they but illustrate another application of the methods above outlined, for the marks representing one, two, and three are at once recognizable as depicting the little, next, and middle fingers of the left hand, held horizontally, however, and therefore read vertically. Four seems a representation of *nearly* the whole hand, and five, originally at least, of the whole hand, both on the same plan. Here again the influence of counting numbers on the hand may be seen to have affected the direction of number-recording as well, which with the Chinese is vertical, not horizontal, and which has in turn determined apparently the direction of all their writing. That like hand-usages in numbering, then recording, had equally determinate influence on the trends of nearly all other systems of writing could be almost as easily shown.

(d.) *Other than delineative number records: (1) Tallies*.—Let us now discuss some other than delineative methods of number-recording which are more appropriate here, as they appear to have been in-

fluenced no less by finger-counting in identical ways. Such are the notched tallies on which either a V-shaped notch (*a*, Fig. 21) or its

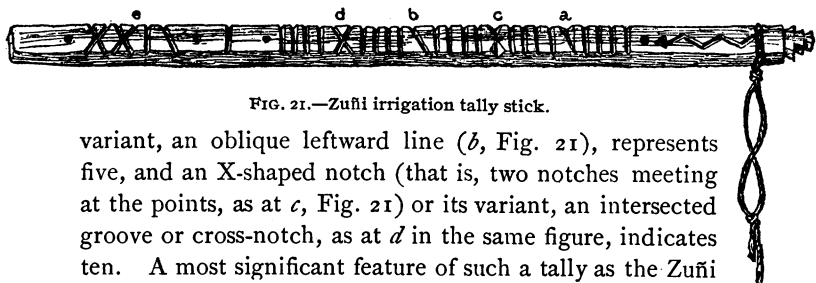


FIG. 21.—Zufi irrigation tally stick.

variant, an oblique leftward line (*b*, Fig. 21), represents five, and an X-shaped notch (that is, two notches meeting at the points, as at *c*, Fig. 21) or its variant, an intersected groove or cross-notch, as at *d* in the same figure, indicates ten. A most significant feature of such a tally as the Zufi irrigation stick is that when used as an unbroken score the record begins at the right end, progressing toward the left; but when the numbers are separated on one, as in the dance calendars, then each is read from the left toward the right for a reason already given, though as a whole it may still be read from the right leftward. The name of such an instrument in Zufi is also suggestive. It is *a'-wi-yäl-li-ni-k'ya 'thlam'*, "all-of-itself-to-make-up-come-successively-for stick," or "all of them [the finger or number marks] to make [show] up after one another stick for;" *i'-yä-li-k'ya*, to count, being, as far as it goes, similarly derived—that is, from the practice of showing up the fingers successively in counting.

(2) *Knotted strands or quippos*.—No line of this inquiry is more interesting than that of hand influence on number and other recording by means of knotted strands, because while fortifying the claims of this thesis, it at the same time reveals important features in the hitherto unexplained origin and development of quippos. The Zufis had made a beginning in this strange sort of string-writing and with it plume-writing.

From their language it may be gathered that they once had "song-strings" or "song-lines," "tribute-strands" and "war-cords" or records, etc., survivals of which may now be seen in the mystic knots of their secret cult societies and in the variously knotted cords appended to their sacrificial plumed wands which are supposed to tell their prayers to the Beings of Space.

The simplest knot known to the Zufis was spoken of as the "finger-knot" (Fig. 22), because tied by a twirl of the forefinger alone, as the same kind of knot is now tied by seamstresses. Because tied with a finger, it was not only known as a finger-knot, but

came naturally to mean *one*. Two such knots meant of course *two*, and three such knots the number *three*. The finger-knot, given an additional twirl by means of the thumb and forefinger together (as used in joining two threads by expert weavers and spinners), be-



FIG. 22.



FIG. 23.

came, with the Zuñis, the thumb-knot (Fig. 23). Now the thumb-knot, of course, meant five, and this with a single finger-knot before or above it meant four (Fig. 25), and with one, two, or three finger-knots after or below it, meant six (Fig. 26), seven, and eight.

So also either the knot which required two hands for the tying of it, or the double thumb-knot in one (Fig. 24), came to mean "the two hands," and so *ten*. By placing a single finger-



FIG. 24.

knot before or above this double thumb-knot (Fig. 27) *nine* was



FIG. 25.



FIG. 26.



FIG. 27.



FIG. 28.

signified, whilst a double thumb-knot followed by a single finger-knot (Fig. 28) meant eleven, and two double thumb-knots followed by a single finger-knot (Fig. 29) meant twenty-one. In all these we see precisely the same principles of reasoning and processes employed (because always suggested, or indeed made needful, by the hands) that have hitherto repeatedly been exemplified in this paper.

It may readily be inferred that a people given to weaving, netting, feather-twining and embroidery so much as were the ancient

Zuñis and Peruvians would hit most naturally upon this method of recording, and that, possessing such basic knot symbols as have been shown, might go much further toward veritably weaving or knitting forth their most intricate thoughts.<sup>19</sup>



FIG. 29.

IV. *Influence of hand usage in left and right finger-counting on ceremonial successions, etc.*—It is now possible to demonstrate the controlling influence of finger-counting on the successional arrangement of the cardinal points or world divisions, and therefore on the lines of succession and directions of turning in ceremonial circuits and serial-marshallings, and of organizations of these and other kinds, as well as of the structural arrangements appertaining thereto.

It is the same to-day as it was in times ancient with the Zuñi when he uses his fingers as indicators. When calling attention to a single object only, he points as we do, with the index finger of his right hand ; but if indicating a series of objects, then he

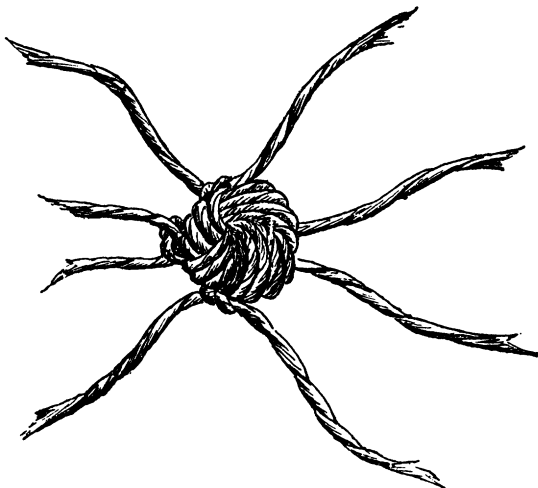


FIG. 30.—Zuñi "spider" or "water-skate" knot.

points out the first one with the *little finger* of his *left* hand, palm upward, and the second with both it (involuntarily) and the finger next to it, whilst the third object will be pointed at with the middle finger, the fourth with the index finger, and the fifth still with the index finger, but with the thumb extended and the palm turned upward.

If, say, the third object be pointed at a second, third, or fourth time, invariably the middle or third finger will again be used as at first, and it is likewise with whatever finger agrees with the serial number pointed out or meant a second time or repeatedly. This forcibly shows the power of apparently trivial action-habits to survive throughout indefinite numbers of generations; for this peculiar usage in indicating can only be conceived to have arisen before the origin of adequate speech in the effort to indicate connection, succession, and rank or precedence by means of gestures; that it was thenceforward kept up in the relating of successive events, even after names for numbers had been developed, but while yet no words for first, second, third, and fourth had been evolved from them, is equally conceivable, and that the inception of all this was involved in the origin of finger-counting itself, is at once apparent; that it would also influence (through gesture indication and naming) the placement in succession of the cardinal points, etc., may be made evident if we consider some of the aspects of primitive man toward extraneous nature. To him, the all-important factor in the universe was the Sun. It was the Maker of day and Renewer of life each morning. As such its chief place was the point on the horizon whence at dawn it came forth. Therefore all other points of the horizon would at first be located or arranged with reference to this one; but with all ancient peoples who, like the Zulus, normally developed their numerical system previously to or alongside of their ceremonial placing and naming of the cardinal points (or sources of the wind-phenomena and gods), these points were but naturally arranged serially and *leftwardly from* the east, or the region of the rising sun. With this in view—and itself already indicated by the mere gesture for the rising sun—the next point, or the north, was, of course, the first thereafter. Therefore it was necessarily indicated or counted (according to the usage I have described) with the little finger of the left hand, and consequently came to be referred to as “the first finger [cardinal] point,” and hence conceived of as the *first* cardinal point, a conception which, through mythical fitness, would surely prevail. In the same way the next cardinal point, or the west, being symbolized by the second or next leftward finger, became the second cardinal point, the south the third, and the east the *fourth*<sup>20</sup> instead of the first. Finally, with a people far enough advanced, the next point to this, because in the direction of the sun rising from it, was the zenith, and the next to



this in turn (because following the setting sun to the world of night) was the nadir, whilst the first and seventh as well as this world itself, or the center of them all.

Each cardinal point was characterized by many things differentiating it from all the others: in the Northern Hemisphere the

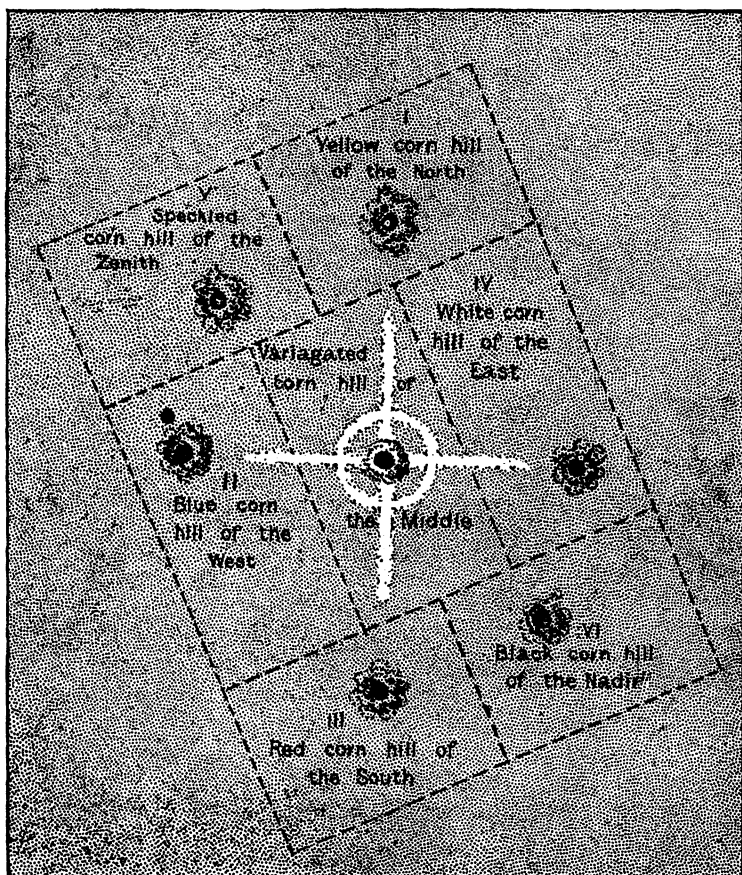


FIG. 31.—Ceremonial diagram showing distribution, etc., of corn-hills in consecration of field.

winds of the North were cold, bringing winter; those of the South warm, bringing summer. So the East was the land of day, of awakening and "life-completing;" the West the land of night, of sleeping and dreams, death and souls or "life-finishing," whilst

the Above was the world of clouds, and the path of day the source of seed ; the Below, that of darkness and its terrors, yet the place of fertility and growth and of all becoming.

Nevertheless, though one journeyed afar, this world remained measurably the same ; for the north, the west, the south, and the east remained ever the same in relation to it. Their phenomena were ever present, yet *they* were ever beyond. They must, then, be Worlds or Regions by themselves, and must be peopled by great gods, the causers or commanders of their severally characteristic phenomena, whose representatives in this, our own world, or the Place of the Middle, must be the animals, mortal or phenomenal, specially resident in the northern, western, southern, or eastern parts of this world.

The Masters of all these Gods of the Spaces and God animals of the related regions were those of the North, because resident in the First region and because, therefore, the Elders, as among men the first are the Elders and Masters. For that reason, no doubt (thought the primitive Zuni), they were the most powerful, hence the fiercest ; the most implacable, hence the first (yet most difficult) to be propitiated.

Thus, too, the gods of the other regions assumed their ranks and supposed relationships, those in each of the series becoming the younger brothers of those in the last before it, and their relative powers and mutual dependencies were explained with unfailing and equal readiness. Thus, until the Gods of the North withheld their icy breath, how could those of the West or the souls there breathe moisture over the land? And until the moisture from the West came, how could things grow in the warm breath of Summer sent by the Gods of the South? How mature and ripen without the age-drying drouth and tempering breath of the Gods in Dawnland?

Now, in order that these Gods of the several regions might be properly approached and entreated, wise men (the Elders of clans related to or most nearly connected with the chief animals of these same several regions, hence named after them) must become their Protopriests, and since thus constituted the Protopriests, of, say, the North, they were in special favor with the Gods of the North. Being of the North, they must be the First, the Elders of the other Protopriests, as their Gods are the Elders of all the other Gods. They also must have a place named of the North, their next younger brothers a place named of the West, and so on. So also they must

have followers of whom they are both Fathers or Protopriests and Chieftains, and these are the children of their own clans named after the animals of the North, and finally these children or followers must in turn have an abiding place, which shall be called the "Place of the North," in which shall be the precinct of these Protopriests of the Northern Gods, wherein they shall worship and keep their sacred "Powers and Medicines," their symbols and fetiches of Winter and the North, wherein to hold their secret assemblies. Thus, too, it must be with each other region—it must have its Protopriests and they their followings, all properly assigned in places cardinally named or "word-placed."

The number of regulations which such arrangements have given rise to with a people like the Zúñis is legion, dramaturgically affecting, as it has, absolutely all their ceremonial life and well nigh all their institutions and organizations, whether religious and sociologic or regulative and merely governmental; whether of the tribe, the clan, or the family, or whether in the arrangements of the town, the kiva, or the dwelling. As an instance, the order of all dances during the year must accord with this, for the clans take precedence in the times or seasons of the celebration of these, mainly with regard to the relation of their totems to the North, the West, the South, the East, the Upper or the Lower regions, and the relations of these in turn to the elements of wind, water, fire, and earth, and to winter, spring, summer, and autumn. Yet in each dance or celebration each region must be represented by appropriate leaders of sections, whose precedence is arranged with like due and scrupulous regard to the sequence of the several regions and seasons they also represent.

Formerly the greater divisions were far more pronounced than now, as may be inferred from the fact that the Zúñis are the descendants of dwellers in the celebrated "Seven Cities of Cibola;" for in these the totems of the North dwelt in a village by themselves, those of the West in another, of the South in another, and so of the Eastern, Upper, and Lower, whilst those of the Middle dwelt in another town, apart from all the rest, itself subdivided into wards or septs (as is modern Zúñi), itself also the tribal head—ceremonially ruling all the rest, yet ruling through resident protopriestly representatives of and from all the rest, in due order of precedence; only, here in the Midmost place, these were under the Sun or Father-Protopriest, and the Seed or Mother-Protopriestess, in at least all

religious and ceremonial concerns. A curious prototype or parallel this, it would seem, of Cuzco with its upper and lower divisions, and therein paired wards of representatives and rulers from all the "Suyus," and over all its Inca Father of the sun, its Inti Mother of the earth.

Again, in at least the central town of Zuffi were (and are) six kivas; but in any one of them any ceremonials relating specifically

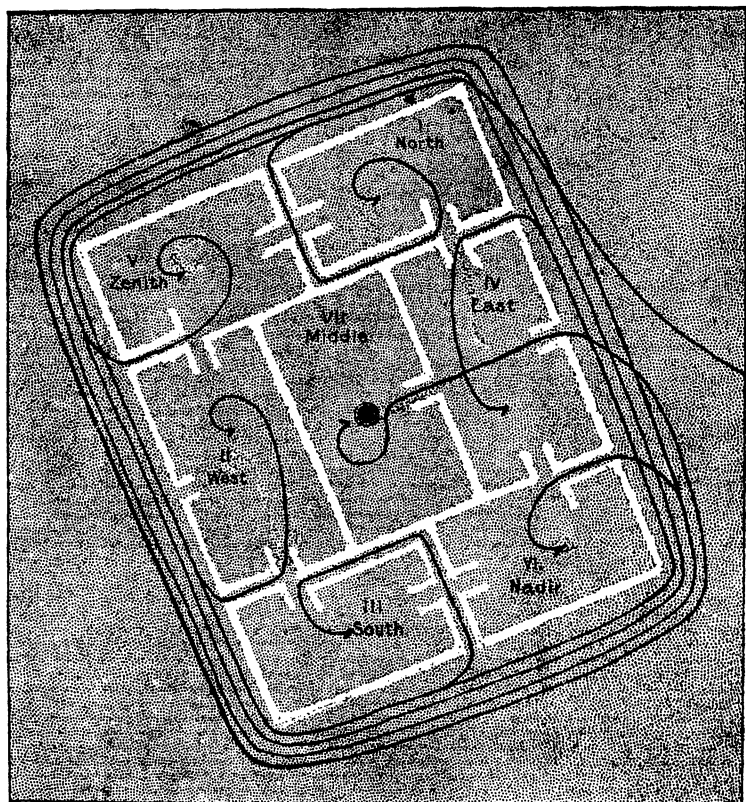


FIG. 32.—Ceremonial diagram in prayer-meal of the seven ancient spaces, showing four-fold circuit of entrance.

to all the regions will be performed by the leading Protopriests of the North, West, South, East, Upper, Lower, and Middle regions, each duly placed within a division of a diagram on the floor made with prayer-meal (Fig. 32) of all the kivas arranged around a central

space so that all may be entered from the right ("east") leftwardly in a four-fold circuit or "procession of seating," first, of "The Four," then (second) of the Uppermost, then (third) of the Nethermost, and, finally and singly, of the Midmost "Father" or "Seater of All." <sup>21</sup>

In each of the great cities or aggregations of pueblos which we excavated in the Salado and Gila valleys, I found that these six kivas were there also aggregated, like the many pueblitos, into a temple kiva as it were, the home or storehouse and stronghold and the place of sacred assembly of the Protopriest rulers over the wards or pueblo divisions of those cities. Each of these structures, which I have heretofore perhaps injudiciously called temples, contained from one to six or seven superimposed *sets* of either five (as in the celebrated Casa Grande, Pl. I) or seven chambers or halls of ceremony (as in the great kiva mound of Los Muertos). If five, then the Northern and Southern were nearly twice as large as the others, to represent not only the Northern and Southern but also the Upper and Lower regional divisions. It is significant, too, that the circuit of these chambers was made from the east, and thence leftwardly to the north, west, south, and east, and finally from the east to the center, whence no connection by doorways was provided with any of the other rooms than the eastern (compare above plans). The temple of Vira Ccocha of Peru was built on a grander scale, but on this same plan, and it is safe to say that both kinds owed their origin and probably placement, as heretofore suggested, mainly to such placing and sequence of the cardinal points as I have referred to. It is not too much to assume that this placement was founded upon unavoidable prehistoric usages of the hand, whether or not it denotes identity of culture origin.

It has been my object rather to suggest that the hand of man has been so intimately associated with the mind of man that it has moulded intangible thoughts no less than the tangible products of his brain. So intimate, indeed, was this association during the very early manual period of man's mental growth that it may be affirmed to be, like so many other hereditary traits, still dormantly existent in the hands of all of us to a greater or lesser degree.

For the hands have alike engendered and attended at the birth of not only all primitive arts, but also many primitive institutions, and it is not too much to say that the arts and institutions of all early ages are therefore memorized by them. In other words,

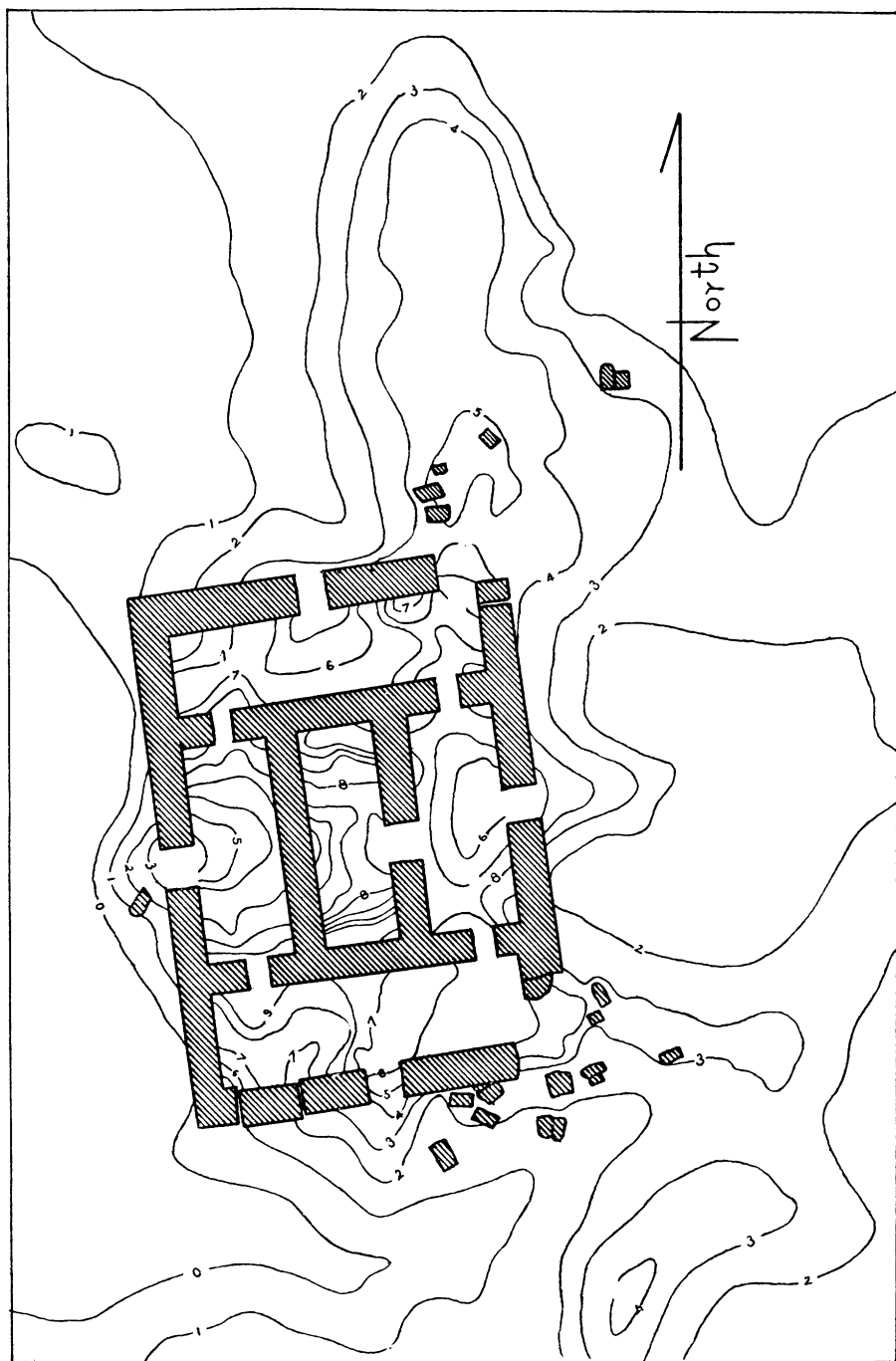


PLATE I.—Ground plan of Casa Grande, showing orientation. From survey made by Cosmos Mindeleff of the Bureau of Ethnology. Scale about 20 feet to 1 inch.

their acts and methods in the production and working out of all these arts and institutions survive as impulses within them, as do obsolete organs in changed animal species; yet more, they survive according to well nigh the same laws of persistent organic inheritance.

It is chiefly through these survivals within the hands that the embryology of the arts themselves may be traced and studied, a knowledge of which subject is as essential to the proper understanding and classification of man's technical activities, at least, as was that of organic embryology to the comprehensive view and modern classification of biotic species.

The method of retracing these lost steps in the growth of the arts surviving in the hands of man is comprised in simply turning these back to their former activities, by reëxperiencing through them, in experiment with the materials and conditions they dealt with in prehistoric times; times when they were so united with intellect as to have been fairly a part of it.

That these survivals are so potent still as to make the hands alone fairly infallible guides (almost without the aid of mind, save to give, as it were, hypnotic suggestions to them) toward the reconstruction of any work or activity, however complicated, that was long persisted in during periods in the development of our race; and that such experimentally re-awakened hand faculties work so perfectly and independently in the main that they form almost a sixth sense, a manual-mental method of true divination concerning the lost arts, I shall hope to show in another paper on the Interaction of Hand and Mind in the Growth of Culture.

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#### NOTES.

1. Investigation of the Zúñi language in reference to this idea is quite conclusive in this respect. The entire language is freighted with fossil concepts, and in studying closely the structural organism of these dead ideas one finds how they were born and grew, and that they were more often than not both implanted and made to grow by the hands alone: 1st, as used in action or in simulating actions; 2d, by the vocal imitation of the sounds naturally associated with such actions or with their effects. This is exemplified in a measure by analysis of the Zúñi term "to kill," which is *a'-yi-i-nā-ti'*, to hurt in a violent or deadly manner; from (1) *a-yi'* + *!*, the exclamation of pain or cry of distress or hurt; (2) *i*, itself; (3) *in*, which is, etc. (*i. e.*, that which is meant, as explained elsewhere);

and (4) *te*, to be or being, which, changed into *tī'* (from *te-ih'* or *t'ih'*), comes to signify "something being done to it," (viz., that which is meant, *i. e.*, the one violently hurt). In this it may be seen that *a-yi' + !*, the cry of inflicted hurt, came to mean, when accented, hurting, because it always resulted from hurting; and, with the addition of *i-na-tī'*, virtually "that (or itself which) has done to it," etc., it came further to mean hurting anything. By itself, however, *a'-yi-i-nā-tī'*, like the Spanish *matar*, might mean either to kill or only to beat or otherwise violently hurt. That it might be made to mean actually to kill, "very" or "really" had to be prefixed to it, as, *ās'-shee-a'-yi-nā-tī'*, really or very (much) to kill. Now, *ās'-shee* is derived from (1) *ās'-sī*, hand or fingers; (2) *ī'ssh*, extremely exerted or clutched (doubled up tightly); and (3) *te*, it (or they) being. In this construction a two-fold record is beautifully preserved. It reveals the fact that the hand was used to express "very" by being doubled up or clinched tightly, and *ī'ssh'-te* was an equally appropriate sound with which to describe or vocally convey this symbolic act, since it simply exaggerates the suppressed grunt, *ī'ssh*, almost unavoidably uttered when one is very tightly squeezing, or grasping with might and main. This same natural expression or exclamation of effort (*ī'ssh*), formed the root of many related terms, some directly derived, as *hī'-ish-te*, excessively; some indirectly derived, as *āsh'-shī'-a*, to die; *āsh'-sk'yēn-na*, making (in the sense of fashioning); and *āsh'-k'eya*, to do, in the sense of to make and to make to (do), whence "compel," etc. All this is but a mere tithe of what might be given, not only along the special lines just illustrated, but further, to show that the extreme specialization of verbs—active verbs particularly—in primitive languages is also probably due, first, to the essential relations of the hands to such acts or in the imitative repetition of them for expression, as above; second, to the limitations of manipulatory operations with only primitive or stone-age appliances (see note 11), one long-surviving inheritance of which would seem to be the irregular verb in modern languages. At any rate, the etymology of verbs, as well as adverbs, in the Zúfi, divides them at once, constructively, into several classes; for instance, those directly derived; in verbs relating to acts performed with the hands, as, with something, to something, at something, in something, out of something, from something, etc.; and again, verbs relating to acts performed (or actions occurring) without the agency of the hands, less directly derived, by vocalization of the sounds accompanying such actions or occurrences, modified by vocalizations suggestive in like manner of the hand imitations of parts of such actions or occurrences. In this fashion the so-called verbal genders or inflectional devices for specializing mode or relativity in any one of these verbs of action have resulted, in a majority of instances, from efforts to thus suggest or picture in sound, *particular* hand-relations to the acts, or rather *parts* of acts, or gestures of the actions or parts of actions, they signify. There was in this process grammatical inevitability. In itself it could not fail to effect



complex, yet mechanically systematic, expression-thoughts or utterance-concepts in the minds of primitive men before or as fast as they evolved even approximately equivalent verbal utterance. So, in one sense, at least, the literally manifold original languages of man were in old time born, as are the infants of men to-day, pre-natally organized and formed.

2. *T'a'-pi*, from (1) *te'-a*, being (there); (2) *a'ha*, to lift suddenly from or displace; (3) *po'-a*, standing (there); (4) *i'-in*, toward self. (See note 3.)

3. *I'-in*, from *i'-me*, to be sitting, whence *in'-nai-e*, to be sitting or dwelling within; *in-na-i-ne*, the constantly within-sitting or in-dwelling, the inself itself of a thing (the thing or part of a thing meant):

4. *Te'-u-o-na*, from *te*, contraction of *te'-a*, to be, whence *te'-u*, to do, and *te-u-o-nat'*, the one which has done to it.

5. *Kw'-i'-ho*, from (1) *kwa*, not; (2) *i*, self or itself; (3) *i'*, off of division; (4) *ho*, need (not), a derivative of *há*, I myself; (whence *há'-i*, being, an existence—anything having “I” or “myself” in it—*hám*, of myself, and *hom+* or *hom'-a*, of myself got mine; whence again *ho*, essentially of or to myself).

6. *I'-wi-li*, from (1) *i*, self or itself; (2) *wi*, selves or more of self; (3) *li'-a*, like in line or form.

7. In turn derived from *i'-ha-ki'-thl-na*; (1) *i*, itself; (2) *a'há*, to lift from or part, etc.; (3) *k'i'-thl*, an-axe-as-with (in hacking and breaking sticks); (4) *na*, self-which-is, etc.

8. It will be noticed that in this name for Three, *ha'-in*, derived from *i'-ha-k'i-na*, two very significant sounds are omitted—the prefix *i* (the thing itself which is, etc.) and *k'*, a still more important initial sound of the second syllable, since it chiefly shows what is done to that thing. But it must be remembered that the primitive Zúñi habitually counted up to the number he meant to express, and in thus putting his separate numerals together he as effectually wore off their edges as though they had been material objects. In saying “one, two, three, four—four” he would encounter the difficulty of repeating the terminal vowel of his word for two, with the prefixed sound in his word for three (*kwil-li' i'-ha-k'i*), which would render the prefix sound meaningless and lead to its elimination. So, also, in going on to count four—*i'-ha-k'i a'-wi-te-k'i* run into *a* would confuse the meaning so that it too would be suppressed to a mere catch in the breath before the terminal *i*.

9. See note 7; *i*, meaning self, the object referred to, following any other of the vowels, usually becomes *wi*, expressive generally of agreement in number; but following *a*, it usually implies not only plurality, but also the dative relation or possession, as expressed by to and of; hence, *a-wi*, all of them, corresponding in this respect to *a'-wa* or *a'-wan*, all of theirs, which is made up (by adding *w* in the same way) from *a*, all, and *an*, its, to or of it.

10. *Ten'-a*, from *te'-a-ni*—(1) *te'-a*, to be; (2) *ēh*, left off or out, and (3) *a'-ni*, going, or *a'-na*, going now. The latter form is in turn derived from *an-i'-ha*, will be going (at once), or, is about to go (away); from *an*, to go or move; *ih*, to make start (that is, suddenly, probably from the effort-exclamation of throwing, used as representative of a gesture to catch up and cast), meaning start, or to make start; *a'ha*, to displace, etc. (see note 2). The simple syllable *te* originally meant space, as found in *te'-'thlā-shi-na* (ancient space); *te'-k'o-ha-na*, daylight (= whited space); *te'-k'wi-na*, darkness (= blackened space); *te'-ul-in*, interior (= enclosed space), etc. *Te'-a*, to be, seems to contain this element, possibly derived as *te* space, *a*, there, something (out) in space. It is necessary to consider this fact as bearing on the close identity of *ten'-a* (being used up, exhausted, empty) with such unrelated words as *ten-i*, laborious, difficult; *ten'-a-la-a*, time; *ten'-nan-ne*, song; *ten-ā-ti'*, fate, inexorableness, etc.; all of which readily may be traced to kindred beginnings and gestures.

11. *Ōp'-tse* or *āp'-tsi*, from (1) *ā'-chi-ēn-ne* (a stone knife); (2) *pa* or *po'-a*, to place against or on; and (3) *tsi'-a-ā-ti*, to tear violently. *A'-chi-ēn-ne* (knife) is itself derived from (1) *a'-a*, a stone; (2) *chi'-a*, to scrape, and (3) *ne* or *ē'-ne*, anything made for, the suffix invariably added to the names of instruments, and derived from elements in the word to fashion or make with the hands. (See note 1.)

12. From *a'thl'-na-ti*; (1) *a'-ha*, to displace or lift from, etc. (see former notes); (2) *'thle'-a*, to carry or bear (with the hand); and (3) *ti'-na*, to stand or station beside.

13. I am not yet certain about the derivation of this important verb-particle, the soul of Zuni verb changes. It is possibly from *ya'-k'i-a*, to complete, itself of intricate derivation, from *ya'-a*, to grow.

14. *Tem'-'thla*, from (1) *te'-a*, to be (see former notes); (2) *em'-ma*, much (to repletion); *'thle'-a*, to carry to, etc. (See note 12.)

15. *Yā'thl-to-na*, probably from (1) *i-yāh'*, to catch or snatch up; (2) *'thle'-a*, to carry (with the hand); (3) *ti'-na* to stand beside; (4) *o'-na*, that which is; something which is.

16. *K'yēn*, doing, done, or doing repeatedly, from *k'ya'-i-ne*: (1) *k'ya*, done or done to; (2) *i'-a-ne*, itself going on.

17. It will much surprise me if it be ultimately learned that such letters of the Roman alphabet as were used simply or combined for the recording of the cardinal or index numbers were not *first* used *thus*, and *afterward* incorporated in or enlarged upon to make or modify parts of an alphabet as otherwise employed; for I believe that number-making was, with primitive man, literally his first hand writing, and that one more important clue for our understanding of how arbitrary and phonetic elements and writing were introduced into picture and syllabic writing, etc., will be found in this, as a natural outgrowth of the manifold mythic con-

ceptions of or symbolic values attached to numbers, and hence to their symbols, by primitive man. Not only could the figures of these numbers, therefore, be combined with other figures to convey the *sounds* of the number names themselves for expressing related sounds, but the well-known regional, color, and other primitive and mystic meanings of numbers (and hence their figures) could have greatly multiplied the meanings of figure-signs when employed as letters or as elements with which to modify meanings of other symbols, especially when with the latter it was sought to depict abstract ideas.

18. I was not a little astonished to find that the Zūñis did not consider the two hands held up apart as meaning ten. I can illustrate this and its cause by my first experience of it as a Zūñi. Whilst I was serving an apprenticeship with the chief silversmith of Zūñi, in 1881, he asked me one day how many *li'-a-li-we* (silver bits or dimes) I had. As my mouth was full of buttons I held up both hands spread out and apart, to assure him that I had *ten* ten-cent pieces. "Alas, son!" said he, "I already have *two half-dollars*," but I was hoping you had ten-cent pieces enough to exchange for them." "But I have," said I, ejecting the buttons and resuming speech in my surprise; whereupon he laughed at my having "*split* the sign for ten," making it "two fives," which he had interpreted as meaning two half-dollars.

19. I have ventured to suggest how this could have been effected with the numeral marks. That with knots it could have been even more readily accomplished I will presently illustrate. The primitive Zūñi, supplied already with an embryo alphabet in the shape of his number or numerical knots, could not only have employed combinations of these to symbolize the mystic or ritualistic values of the numbers they represented themselves, but he could also have greatly amplified the range of significance in the latter by varying the materials of the cordage with which the knots of them were tied; for with him each kind of fiber had a "flesh-name" indicative of its individual nature and function. Again, each of the six common colors with which any one of these strands might have been dyed had a definite regional or locative and successional as well as mythical significance. With all these accessories it was both possible and easy for the ancient Zūñi to modify and elaborate, and so to multiply the primary and even secondary meanings of mere knots. That this was more or less done, according to the above surmises, may be exemplified by reference to one or two of the symbol-knot survivals in the ritualistic paraphernalia heretofore alluded to.

The "spider" or "water-skate" knot of the Zūñi secret cult societies of war and the chase was tied usually with a four-fold strand (Fig. 30). With the ends of the two middle strands at one extremity shortened by twirling together, the node signified not merely the spider, but the *chief power* of the spider—that of snaring invisibly. If the knot were tied in yutca-fiber it signified the desired magic power of the initiated hunter

to capture or ensnare the heart of the game, the yucca-fiber symbolizing the hunter, because it was capable of withstanding rain as his bowstring, was used for his sandals, abounded wherever he roamed, and was therefore always employed by him to tie the legs of the game he had slain, and was held to symbolize the heart of the animal to be captured when taken from the heart of the plant itself. (See Zufi Fetiches, Ann. Rep. Bur. Ethnol., II, p. 35). Placed on the trail of a startled deer, the yucca spider-knot constituted a hunter's invocation, asking that the deer be retarded, or that his heart be entangled and his footsteps confused. If the front strands were twisted to points, or the natural spines of the yucca leaf were left on them, and so placed as to point toward the course of the deer—backward along his trail—then it constituted an invocation that the deer be not only retarded, but also that the warrior be enabled to outstrip him and stop short his course with his arrows—sharp-pointed as the preying horns, probosces or short fore-claws of the spider were pointed. Made of sinew from the mountain lion, this same knot became the *warrior's* invocation-offering on the trail of the enemy, with even a greater capability of varied meaning, whilst if made of cotton (the flesh of the fair goddess) it was the proto-priest's prayer-symbol beseeching light and the power of detecting and entangling the ghostly emissaries of the dread sorcerer.

The knot of the water-skate differed from the spider-knot only in the shorter antennæ and greater length of the strands, which were made, moreover, to radiate more equidistantly from it; yet it had a significance marvelously apart. As a whole it represented not the water-skate only, but the world itself; because the water-skate, ever resting over the pools as the world rests over the primeval sea, and possessing four radiating legs and two pointers as the world is the center and possessor of the lines of the four quarters and of the zenith and nadir, is the god of the world or rather of the seven regions. But, made of yellow, the knot became the sign of the north-god region; or of blue, that of the west god, and so on. Again, if made of yellow (north) and red (south) intertwined, it became the symbol of winter and summer; or if of yellow, blue, red, and white, then the symbol of the four seasons. To merely hint the further possibilities of this simple symbol, it remains only to be stated that the skate-knot of dun-colored cotton, in the upper loops of which some untwisted flecks of cotton-down have been lightly twirled, comes to signify "the clouds of the world." But I will only add my opinion that the quippos will be found to have had a development from such mythic and mystic hand-made beginnings as these, and that with equal likelihood the presence of the numerous knot-symbols in the painted or carved writings of Mexico and Central America have had a similar genesis—that is, in a former practice of knot-recording and a symbolic meaning of knots in paraphernalia and the arts, etc.

20. As I have said, this seems the normal line of development, ceremonially, since it has characterized the greater number of ancient tribes and peoples, especially those inhabiting single regions for long periods. But there are exceptions. The nearest northern neighbors of the Zuñis, the Navajos, neither recognize the same number of regions the Zuñis do, nor do they name or range them ceremonially from the right leftwardly, but from the left rightwardly. This arose probably, as I have suggested, from the fact that their relative progress in ceremonially naming the world quarters and in naming their numbers was not the same. This would likely be the case with a wandering or unfixed people, with whom also in rare instances some factor, such as the direction whence they migrated, the source of something important to them, or a variety of other influences, would operate to render some one of the cardinal points more important mythically than another—that is, if the rising of the sun and its course rightwardly to the south and west had not already done so. Furthermore, the lack of the relative number-names up to four, either in gesture or speech, would leave the sequence also more likely to take a dextral turn, of course, than a sinistral tendency. This might and probably would be transformed to a sinistral succession after the development, in the ways I have described, of a more perfect number-phraseology, or the adoption of a more sedentary habit of life within a circumscribed area. The wandering or drifting peoples, at any rate, more often range the cardinal points dextrally than sinistrally, and their point of departure is usually also from the east or the rising of the sun, whilst the opposite is, in a like general sense, true of more settled peoples.

In view of these facts, great importance attaches to a study of the particular conception and arrangement of the world quarters, characterizing any given tribe or people, or shown in monuments of such; for their former condition of life and often even their earlier habitat, or again, in case of vanished peoples, their grade of culture can be correctly approximated therefrom. Many lines indicative of this might be followed up, but I will here essay limitedly only one, because it seems to illustrate quite importantly yet another consequence of the sinistral arrangement as above accounted for. Naturally the wanderer locates the cardinal points by the sun, usually, therefore, making the east his first point, the south his next, and so on. No matter how far he may fare, his cardinal points, so far as he takes account of them, will be true to the sunrise at the time of year when he locates them. Not so, however, with a people long settled in one region, then migrating to and settling in another. Their chief cardinal point having previously become the north in ways already shown, they are far more apt to misplace it, either accidentally or intentionally, and accordingly all the other quarters, than are wandering people who locate theirs by the sun only: (1st) because, having a full sense of the cardinal points of their olden home, they will endeavor to adjust these old points to the new locality, and in doing this will almost unavoidably vary toward the left or west from the true north in

this new country to the extent of at least the solstitial variation at the time, if not to a greater degree. In the latter case, they will claim and locate (2d) because of reasons which will presently be made evident, only *one* set of *quarters*, but *two* sets of *directions*, one—the sacred and “true” world-directions, the other those of the “new country” or of the people they find there.

Illustrations of this are not rare even in America. The Tusayan Indians of Arizona exemplify it in uniformly placing their sacred or world divisional north to between forty-five and fifty degrees west of north, and in constructing some of their kivas accordingly. For a kindred reason the great sacred citadel kivas or fanes in the ancient cities of pueblos in the Salado valley, discovered by me and excavated by the Hemenway Expedition, were found to have been placed with reference to a preconceived or else conventional set of directions. But this arbitrary placing of the world quarters was carried further, perhaps, by the ancient Incas (as shown not only by history, but also by the orientation of Cuzco itself and of the many sacred sextenary or septenary structures throughout Peru) than by any other people, except we turn to the old world. There the Chinese, whose sacred nomenclature shows either that they at one time almost completely reversed the points of the compass in their slow shifting from the west in Asia to the land they now live in as the midmost of the world, or else that they never varied an earlier conventional setting of these points according to or at least like the Babylonian system. This latter led to the well-known placement of the Babylonian and Assyrian temples obliquely to the cardinal points—that is, with the angles toward instead of the sides facing north, west, south, and east; and I think it originated—so far as exemplified in these temples—in the effort to arrange within them quarters to correspond serially and leftwardly to the six cardinal points or world regions outside of them. The reasons I assign for this may as well be briefly and simply explained here.

When a Zufii Prot priest consecrates, or begins the planting of the father and mother seeds in the center of a corn-field, he makes a hole in the soil, usually in the middle of a circle of prayer-meal (Fig. 31). Over this he marks a cross, also in prayer-meal, the four arms of which reach out toward the four cardinal points. At the extremity of each arm of this cross, beginning with the northern (*i*, Fig. 31), he digs a planting hole. Then, moving his planting stick around and toward the left, outside of these, he digs a hole to the left of and slightly *below* (or south of) the northern hole (*v*, Fig. 31), and again moving his stick around the entire circuit, digs another hole to the right of and slightly *above* (or north of) the southern hole. Finally, moving his stick once more entirely around the circuit, he places it in the central hole.

Now, if an effort were made to construct a parallelogramic temple with quarters in it to represent, as do these seven holes, the seven regions, in which quarters ceremonial progressions or processions were to be per-

formed (as they are dramaturgically performed by the Zuñi with his digging stick and afterwards with his corn grains) from the right (or east) side leftwardly, then the result would be the placing of the parallelogram obliquely and leftwardly to a line running north and south, in order that, as I have tried to indicate by the dotted lines in the accompanying diagram, the northern quarter (*i*) might be above or truly north of the upper quarter; that the southern quarter (*iii*) might be below or actually south of the lower quarter (see and compare diagram, Fig. 31, with plan of the "ancient spaces," Fig. 32, and of Casa Grande, Pl. I).

21. In this may be seen either the origin or a development of the invariable four-fold circuit or procession four times leftwardly around the altar, shrine, or other receptacle of offerings—as a dramatic coming from or going to the six regions in succession—the four first regions being comprehended in a single circuit—as pertaining to the single plane of this world alone, whilst the visit to the *Middle* must have a circuit by itself as comprehending or representing all the rest in this world.

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THE MEETING OF THE AMERICAN ASSOCIATION for the Advancement of Science was held in Rochester, New York, August 17-24. In Section H, devoted specially to anthropology, the presiding officer was Mr. Wm. H. Holmes, of the United States Bureau of Ethnology, and the secretary Rev. W. M. Beauchamp, of Baldwinsville, New York. The following are the titles of the papers read:

River Pebbles Chipped by Modern Indians.....	H. C. Mercer.
Cañon and Mesa Ruins in Utah.....	W. K. Moorehead.
A Few Psychological Inquiries.....	Laura O. Talbot.
Indian Camping Sites near Brookville, Indiana.....	Amos W. Butler.
On Some Prehistoric Objects from White Water Valley..	Amos W. Butler.
Early Religion of the Iroquois.....	W. M. Beauchamp.
Early Indian Forts in New York.....	W. M. Beauchamp.
Ancient Earthworks in Ontario.....	C. A. Hirschfelder.
Evidences of Prehistoric Trade in Ontario.....	C. A. Hirschfelder.
Anvil-shaped Stones from Pennsylvania.....	Dr. D. G. Brinton.
Vandalism in Yucatan and Central America.....	M. H. Saville.
Ethnology in the World's Columbian Exposition.....	F. W. Putnam.
Serpent Mound, Adams County, Ohio.....	F. W. Putnam.
Involuntary Movements.....	Joseph Jastrow.
Tusayan Legends of the Snake and the Flute People,	
	Matilda C. Stevenson.
Skull of a Pig with a Spear-head Imbedded.....	E. W. Claypole.
Remains along White River, Indiana.....	Amos W. Butler.
Earthworks near Anderson, Indiana.....	Amos W. Butler.
Primitive Number System.....	Levi L. Conant.

Comparative Chronology <sup>1</sup> .....	W J McGee.
The Alphabet of Landa .....	H. T. Cresson.
Peabody Museum Honduras Expedition.....	F. W. Putnam.
Explorations in Copan, Honduras.....	M. H. Saville.
Aboriginal Quarries of Flakable Stone and their bearing on the ques- tion of Paleolithic Man.....	W. H. Holmes.
Copper Implements and Ornaments from the Hopewell Group, Ohio, W. K. Moorehead.	
Pipestone Quarry and Lake Superior Copper Mines.....	W. H. Holmes.
Proposed Classification and International Nomenclature of Anthro- pological Sciences.....	Dr. D. G. Brinton.
Prehistoric Earthworks of Henry County, Indiana.....	T. B. Redding.
The So-called Paleolithic Implements of the Upper Mississippi, W. H. Holmes.	
A Definition of Anthropology.....	O. T. Mason.
Pueblo Myth and Ceremonial Dances.....	F. H. Cushing.
Recently Discovered Cerebral Porta.....	C. P. Hart.
Points Concerning Fort Ancient.....	S. S. Scoville.
Prehistoric Pottery from Mound in Illinois.....	J. Kost.

The chief discussions were over the papers of Messrs. Brinton, Conant, Holmes, McGee, and Mason, inasmuch as each one of them trenchd on the border of the Debatable Land.

OTIS T. MASON.

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SACRIFICES TO DEPARTED SOULS IN NEW BRITAIN.—“In Duke of York Island feasts are often held in remembrance of the dead,” says Rev. B. Danks in the *Journal of the Anthropological Institute*, Vol. XXI, No. 4. “On one occasion,” he continues, “I saw no fewer than five pigs killed for such a feast. Prior to killing them a whole week was spent in dancing and singing from sunset to sunrise. Men and women, old and young, all joined in the dances. On the day appointed the pigs were killed and cooked whole. Before cutting them up, a man took a knife and cut loose a piece of skin, about two inches in diameter, on the fore part of the skull of each pig. He then stood up, holding an old cocoanut in his hand by the sprouts growing out of it, and calling upon the name of the deceased man said, ‘This is for you;’ he then struck the pig with the cocoanut on the spot where the skin had been cut loose. Each pig was thus devoted to some departed soul. This custom is called the ‘Wetu.’”

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<sup>1</sup> See pp. 327-334.